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THE CHERENKOV EFFECT FOR A MESON FIELD

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[A brief digest of the above report follows.]

The authors discuss the Cherenkov radiation of mesons which occurs when a nucleon passes through nuclear matter and establish that the volumetric portion of this radiation has no significance in the generation of mesons. The authors point that, on the contrary, the processes at the boundary of the nuclear medium can be extremely essential.

When a fast nucleon passes through an atomic nucleus, one can expect radiation of the meson field, like the well known Cherenkov effect in electrodynamics described by I. M. Frank in Uspekhi Fiz Nauk, Vol 30, p 1949, 1946. (The possibility of this effect was pointed by D. Ivanenko and V. Gurgenidze in DAN SSSR, 67, 997, 1949, and by Wada in Phy Rev, 75, 981, 1949.)

The authors consider the speed of the nucleon passing through the nucleus to be constant and disregard the phenomena at the boundary. Thus they investigate the radiation of a meson field by a nucleon moving uniformly in an unbounded medium. Hence meson radiation will be possible only when the wave process inside the nuclear matter can propagate with the velocity of the moving nucleon. Radiation thus occurs only for those frequencies for which the phase velocity of propagation of oscillations is less than the velocity of the particle.

Unlike electrodynamics, mesodynamics cannot admit measurements of potentials; therefore calculations of the medium do not lead simply to a variation in the velocity of propagation of waves. The authors consider the nuclear

medium to be a meson-charged fluid (corresponding to a drop model of the nucleus), able to move under the action of an internal meson field (the field of the nucleon flying through). Obviously one cannot describe this medium by a dielectric constant since the polarizability of such a field depends not only on frequency but also on wave lengths of the wave process.

In the main part of the article, the authors relate ρ the nondisturbed density of the nucleonic fluid, δ the density perturbation, u the velocity of the fluid, p the pressure perturbation, a the velocity of sound, g the charge, and m the nucleon's mass.

In the conclusion, the authors assert that the meson radiation which occurs within the nucleus upon the passage of a fast nucleon does not lead to the generation of mesons. In connection with these results, they took into consideration the influence of the nucleus boundaries, since one must expect that in the passage through the boundary of the nuclear medium by the nucleon the meson field can be broken away and radiate. This radiation is essentially connected with the polarization of the nuclear medium, which is not considered in ordinary calculations of meson radiation. The authors call this radiation "nonretarded," emphasizing by this name that one is not concerned with the radiation of the nucleon passing through but with the radiation of mesons by the nucleons of the medium which (i.e., nucleons) are set in vibration by the primary nucleons.

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